'Cold spots' of urban infrastructure:

'Shrinking' processes in Eastern Germany and the modern infrastructural ideal

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Abstract

This paper explores the unfamiliar, but increasingly prevalent problem of overcapacity in urban infrastructure systems in regions subject to dramatic socio-economic restructuring. Taking the case of water supply and wastewater disposal systems in Eastern Germany as an example, it examines firstly how infrastructure overcapacities have emerged since reunification in 1990, resulting from sharply declining water consumption in the wake of 'shrinking' processes but also from infrastructure expansion. Secondly, the paper analyses what impact chronic overcapacity is having on the governance of water infrastructure systems. This empirical analysis is framed conceptually in terms of the current debate on the changing relationship between infrastructures and the localities they serve. It assesses specifically how far and in what ways the phenomenon of overcapacity in technical networks resonates with the 'splintering urbanism' thesis developed by Stephen Graham and Simon Marvin. It argues that the serious technical and economic problems posed by overcapacity are intensifying spatial disparities in service quality and price and – more fundamentally – are challenging the supply-driven 'modern infrastructural ideal' of universal and equitable water services.

Introduction

One of the near certainties underpinning the provision of infrastructure services for water, wastewater, gas, heating and electricity in the past has been the need to plan for growth. Infrastructure policy and planning have rested on the assumption – largely substantiated over a century and a half of experience in industrialized countries – that demand for services will in general continue to rise and technical networks should therefore be designed to meet higher levels of consumption in the future. Any over-capacity (beyond a certain safety reserve) has generally been only a temporary phenomenon, taken up as more consumers were connected to the grid and the consumption of water and energy increased.

Whilst this is still the case in regions experiencing growth or lacking adequate infrastructure, in other regions – those subject to processes of economic restructuring and population decline – levels of consumption of water, in particular, are stagnating or falling, sometimes quite dramatically. Utility managers accustomed to expanding their physical networks to meet ever-growing demand for water are in some areas having to confront an unfamiliar and unwelcome phenomenon: over-capacity in parts – or even across all – of their infrastructure network. In serious cases the drop in consumption is so great that it is causing major problems for the technical functioning and economic feasibility of infrastructure systems. This can be observed in whole regions of Eastern Germany and Central and Eastern Europe following the dramatic socio-economic transition from a state socialist to a capitalist economy (on Eastern Germany: Koziol, 2004; Bernt and Naumann, 2006; Haug, 2004; Koziol, 2006; Birkholz and Pfeiffer, 2006; Tietz, 2006). In Western Europe instances of over-capacity and under-utilization of infrastructure networks are less widespread but on the increase, for instance in inner-city areas following suburbanization and de-industrialization or in peripheral regions experiencing structural decline.

The theme of 'shrinking cities' is internationally under-explored (exceptions are Oswald, 2005; Oswald, 2006). In Germany, by contrast, there exists a growing literature on the causes, characteristics, consequences and governance of 'shrinking' processes, addressing primarily – but by no means exclusively – the post-socialist transformation of Eastern German cities and regions (e.g. Häußermann and Siebel, 1998; Hannemann, 2004; Weiske *et al.*, 2005) [1]. 'Shrinking' refers in the first instance to two concurrent processes – loss of population and economic decline – which have wide-ranging and far-reaching effects on the functioning and governance of local communities and whole regions (secondary impacts). Eastern Germany witnessed rapid de-industrialisation following reunification in 1990, accompanied by a population decline of ca. 6% between 1991 and 2002. In some medium-sized towns the population dropped by as much as 30% (e.g. Hoyerswerda -29%, Schwerin -21%, Halle -21%), indicating the huge geographical variations characteristic of 'shrinking' processes [2]. As many commentators are keen to point out, 'shrinking' in Eastern Germany is not a temporary phenomenon of readjustment but a "new normality" (Hannemann, 2004) of potentially long duration. Population levels are predicted to decline even further between 1999 and 2020, by ca. 15% in the worst affected regions of Ostthüringen, Nordthüringen and Altmark (BBR, 2003).

This paper explores the phenomenon of 'shrinking' in Eastern Germany from an infrastructure perspective. We seek answers to the following questions: How has the problem of overcapacity in technical networks emerged in the context of 'shrinking' processes? How is it affecting the relationship between water infrastructure systems and the localities they serve? How is it influencing the way water services are provided?

Conceptually, we set our discussion in the context of an ongoing debate amongst urban geographers, sociologists, planners and historians on the 'splintering urbanism' thesis developed by Stephen Graham and Simon Marvin in their eponymous book (Graham and Marvin, 2001). The splintering urbanism thesis is developed around the central observation that the current organizational, institutional, economic and technical unbundling of infrastructure systems is reshaping social and spatial relations in cities and the relationship between cities and their infrastructures (Graham and Marvin, 2001:

166ff). Today's infrastructure systems, they argue, are selectively being rebundled around new logics, technologies, social relations and – above all – new spaces.

The vast majority of examples cited in Graham and Marvin's book relate to situations where demand for infrastructure services is high. The issue is generally about how to meet this high and growing demand for either basic or customized services under changing institutional, economic and technological conditions. By contrast, there is very little mention of situations of declining demand and use, beyond brief references to the vulnerability of infrastructure networks to obsolescence in periods of social and economic transformation and the problems that can arise from the path dependency of infrastructure systems (Graham and Marvin, 2001: 215). In this paper we target this knowledge gap. We are interested in discovering how far the phenomenon of under-utilization of water infrastructures is exacerbating existing socio-spatial disparities in service provision or even creating new ones; in other words, how far it resonates with the splintering urbanism thesis.

The paper begins by summarizing the central message of the splintering urbanism thesis: that the "modern infrastructural ideal" (Graham and Marvin 2001: 39) of universal services for all is being undermined, leading to the emergence of "customised enclaves" and "network ghettos". These we then contrast with so-called "cold spots": those parts of technical networks where demand is weak and/or declining. This empirical section on the consequences of 'shrinking' processes in post-unification Eastern Germany addresses the nature, causes and consequences of the overcapacity phenomenon. Subsequently, we reflect on the nature of the connectivity between infrastructures and cities in the context of overcapacity and socio-economic restructuring, drawing observations on the challenges this poses for infrastructure governance. The concluding section assesses the degree of resonance between the splintering urbanism thesis and the overcapacity problem in Eastern Germany today [3].

From ‘customized enclaves’ and ‘network ghettos’ to under-utilized ‘cold spots’

In their pioneering book “Splintering Urbanism” Stephen Graham and Simon Marvin develop a powerful thesis on the emergence, institutionalization and current destabilization of a “modern infrastructural ideal” of the integrated, networked city (Graham and Marvin, 2001: 39). They coin the term “modern infrastructural ideal” to capture the notion of universal accessibility which, they argue, guided infrastructure policy and planning in industrialized countries from the mid-nineteenth century until around 1960. This ideal provided a powerful rationale for a number of characteristics which subsequently came to characterize urban infrastructure systems: large-scale technologies, territorial monopolies of service provision, heavy public investment, strong state regulation, supply-oriented infrastructure planning and, in many countries, state (or municipal) service provision.

The ‘splintering urbanism’ thesis subsequently advanced by Graham and Marvin is that the modern infrastructural ideal and the policies which it has generated are today being undermined by a combination of various forces for change. These range from trends towards liberalisation and privatisation to uneven urban development in the context of globalisation, from a loss of trust in urban and infrastructure planning to environmentalist critiques of infrastructure policy (Graham and Marvin, 2001: 90-136). The central argument of the splintering urbanism thesis is that we are experiencing today, as a consequence of these challenges, a general shift away from standardized and territorially integrated infrastructures to ones more fragmented and spatially differentiated. Infrastructure managers, the authors argue, are planning and operating their technical networks with far greater socio-spatial selectivity than in the past. This is expressed, for instance, in spatial differentiation in the quality, variety and cost of services, investment levels, employment conditions and technological innovation. Commercially lucrative areas and consumers are benefiting from improved services – often packaged to meet their particular service needs – whilst less valuable areas and captive customers are provided merely with the basic level of service as required by law. The cumulative impact of these differences is the emergence of what Graham and Marvin term "premium network spaces" (also "customised enclaves") and marginalized spaces of infrastructure networks ("network ghettos") (Graham and Marvin, 2001: 289; also Graham, 2000; Guy *et al*., 1997; for a critique, Coutard, 2002). They develop the notion of "infrastructural by-pass" – local, glocal and virtual – to illustrate the way in which infrastructure managers are by-passing less lucrative places and social groups in their quest to provide more profitable, tailor-made services for select customers (Graham and Marvin, 2001: 170-171). Thus the trend towards more fragmented and differentiated infrastructures is a distinctly political process. It is about "the dominant practices of the powerful, in their attempts to construct, manage and regulate secessionary and premium network and urban spaces" (Graham and Marvin, 2001: 384).

If Graham and Marvin have raised awareness of the existence of premium and marginalized network spaces, what do we know about under-utilized network spaces? In their book there is no explicit reference to the impact of urban or regional 'shrinking' processes on infrastructure systems. This may be explained in part by the authors' focus on the Anglo-Saxon world and, to a lesser extent, developing countries. As they themselves concede (Graham and Marvin, 2001: 385) the book does not explore experiences in towns and cities of continental Western and Eastern Europe. Yet it is here where cases of under-utilization of infrastructures networks is particularly prevalent following major economic restructuring, negative demographic development and resource-saving practices.

In many respects this paper explores the flip side of the splintering urbanism narrative. Firstly, it is a story of the cold spots of declining or lost consumption, rather than the "premium network spaces" or new consumption spaces of growth, exploring infrastructure development in the context of urban decline rather than growth. Secondly, the "infrastructural by-passing" here is not so much an act of deliberation by infrastructure managers providing customized services to select customers and territories at the expense of others, but rather an unwelcome necessity to traverse areas of under-utilization in order to reach other consumers. Thirdly, the utility companies in our story are not the agenda setters, creating new services and forging new partnerships, but – in the first instance at least – victims of forces of economic restructuring and urban change largely beyond their control. Fourthly, the changing relationships between service provider and service user – a key dimension of the splintering urbanism thesis – is modified by the additional problem of the *absence* of consumers and how utility companies respond to this. Sensitised to these core issues of recent research on the relationship between infrastructure and urban systems we now examine how 'shrinking' processes in Eastern Germany have helped create a chronic overcapacity problem for water infrastructures.

From the universalization drive to the overcapacity problem: Water infrastructures in a 'shrinking' Eastern Germany

Regardless of the extent to which utility services for water and wastewater are – or have ever been – universal in Germany, the modern infrastructural ideal resonates powerfully with traditions of infrastructure policy and planning there. The objectives of maximising connection to the technical networks, providing a reliable, safe and affordable service and using infrastructure investments to minimize intra- and interregional disparities have acted as a guiding ethos (*Leitbild*) of infrastructure planning and regional economic policy for generations. The logic of 'build-and-supply', based on political aspirations to connect everyone to the technical networks and to support economic growth, has been a powerful motif of infrastructure development from the Kaiserreich to the present day. It has, not surprisingly, been interpreted and practiced in rather different ways during the course of Germany's turbulent history. In the late nineteenth century hygiene and public health were the principal justifications for infrastructure expansion. During the 1920s the argument shifted to infrastructures as instruments of integrated city planning. Following the Second World War urban infrastructures were heralded as pillars of post-war reconstruction. During the years of political division supply-oriented infrastructure policies and the goal of universalization were characteristic for both regimes – East and West – albeit with different points of emphasis. Whilst in West Germany, generally speaking, the focus lay on levels of connectivity, environmental quality and accountability to municipal authorities, in East Germany it was on low service charges and the pursuit of state planning goals to raise production and meet the chronic housing crisis (for a comparison of water services in West and East Berlin see Bärthel, 1997).

The reality of infrastructure service provision in East Germany deviated in other respects, however, markedly from the rhetorical goal of universalization (Markmiller, 1991; Roscher, 1993: 15-17, 24-27; Runge, 1994a: 434-438; Gruneberg, 1998). Connectivity to public drinking water and public sewers did increase during the ca. 40 years of state-socialist rule but only at very modest levels, particularly in comparison with West Germany. In 1987 less than 57% of the population of the German Democratic Republic (GDR) was connected to public sewage treatment plants, compared with 89.7% for the Federal Republic of Germany (FRG) (Gruneberg, 1998: 45). Such overall figures hid huge variations between localities, with connection to public sewers ranging even between major cities from 94% for East Berlin to just 48% for Frankfurt/Oder (Gruneberg, 1998: 44). The quality of the physical infrastructure in East Germany was generally very poor, with – for instance – over half the water mains older than the 40-50 years for which they were originally designed, resulting in frequent pipe bursts and considerable losses through leakage (Markmiller, 1991: 10). Water quality was also poor: in 1990 over 9 million people (i.e. ca. 60% of the East German population) used drinking water which continuously or repeatedly exceeded the limits for pollutants set by the (West German) Drinking Water Ordnance. The state of the sewer network was, according to a study conducted for the Federal Environment Ministry in 1991, roughly comparable with the pre-war situation (Gruneberg, 1998: 45-

46). Of the wastewater collected in public sewers only 52% was treated mechanically and biologically; the rest received only mechanical treatment (36%), or was discharged into rivers without any treatment at all (12%).

Revelations of the dire state of the water supply and wastewater disposal systems following reunification in 1990 were highly instrumental behind the subsequent pursuit of the 'extend-and-supply' logic with renewed vigour. What Eastern Germany needed, it was widely held by infrastructure planners and funding agencies at the time, was heavy investment in the infrastructure to bring it 'up to speed' with European standards (so-called *nachholende Modernisierung*) as quickly as possible. Substantial funding programmes were launched and approval procedures for network expansion fast-tracked in order to enable service standards to meet those of Western Germany and to provide a solid foundation for the economic growth widely anticipated in the early 1990s. The pressure to act drowned critical voices calling into question the economic feasibility of transposing technical and organizational models from Western Germany – with its higher population density, legacy of strong local self-government and economic prowess – onto the Eastern German context (Runge, 1994b). The historical opportunity of exploring the viability of alternative small-scale and decentralized systems of wastewater treatment and disposal was also overlooked in the initial post-reunification euphoria. State funding agencies distributed generous subsidies for municipal water/wastewater infrastructure investment programmes without adequately checking their economic viability (Halbach, 1997: 6). Less scrupulous planning and engineering consultants encouraged inexperienced local decision-makers to build unnecessarily large infrastructure plant in order to inflate their own fees (Geiler 2006: 9).

The initial result of this unparalleled level of infrastructure expansion in post-war Germany was to improve substantially the water/wastewater infrastructure in terms of the classic indicators of the modern infrastructural ideal: levels of connectivity to the public networks, length of pipelines and sewers, levels of capital investment and water quality. Since reunification in 1990 some €50 billion have been invested in water supply and wastewater disposal and treatment systems in the five new federal states (BGW, 2004: 3); statistically, this amounts to over €3,000 per inhabitant. This level of funding led to a major rise in the capacity of the water supply and sewer networks. According to the official statistics, the length of the sewer network in the new federal states and Berlin grew between 1998 and 2004 from 67,896 km to 93,117 km – an increase of 37.1% in just six years (see Table 1). Consequently, the proportion of the population of Eastern Germany connected to public sewers rose sharply from ca. 73% in 1989 (Gruneberg, 1998: 44; Roscher, 1993: 16) to between 82.6% (Brandenburg) and 91.5% (Thuringia) by the end of 2004 [4]. The figures for connection to the public water supply were less dramatic, but nonetheless significant, increasing from 93% (Roscher, 1993: 16) to 99%.

[Insert Table 1 ca. here]

There is no disputing the significant benefits of this massive investment in public infrastructures. Private households, the business sector and public administration in Eastern Germany today enjoy a very high level and quality of water services provided by state-of-the-art technology. The quality of surface water and groundwater has improved immensely as ever more communities have been connected to technologically advanced networks since 1990. These benefits have come at a price, however. The high level of state subsidies for water infrastructure investments will burden state budgets for decades to come. The additional investment costs must be borne by local communities, tying them, too, to a long-term financial commitment. The problem of high infrastructure debt would not have become such a contentious issue, however, if the levels of consumption of water had approached the predictions formulated in the early 1990s.

The irony is that, just as East Germany's water infrastructures were being extended to meet the anticipated growth in demand following economic recovery, the actual level of water consumption in Eastern Germany collapsed dramatically, stabilising today at a figure 40% lower than in 1990 (see Figure 1). As Table 2 illustrates, water consumption in the new federal states and Berlin dropped from 1,345 million m^3 to 794 million m^3 (i.e. by 41%) between 1991 and 2004 (Statistisches Bundesamt, 1994, 1999, 2001, 2003, 2005), and from 1990 by over 50% on the basis of the less detailed and reliable data for that year (BGW, 2005). This decline is, as Table 2 shows, very similar across all five of the new federal states. These figures also reveal that the main drop in consumption occurred before 1995, i.e. in the immediate post-reunification phase. What the aggregated figures for the six states conceal are the huge intraregional disparities within the overall rate of decline. In peripheral and structurally weak 'shrinking regions' of Eastern Germany water consumption has dropped by over 60% since the early 1990s, with some communities registering daily consumption rates of just 80 litres per person. The average for all the new federal states (i.e. excluding Berlin) stood at just 94 litres in 2004, compared with 142 litres in 1990 (BGW, 2005: 12). The areas hardest affected by this dramatic drop in water consumption are today the ‘cold-spots’ of Germany’s water infrastructure networks. At the same time, however, there exist pockets of dynamic growth in Eastern Germany that are requiring network expansion, for instance in new suburban developments. The often close juxtaposition of areas with sharply declining water demand and areas requiring new infrastructure is posing a particular challenge to infrastructure planners in Eastern Germany today.

[Insert Figure 1 ca. here]

[Insert Table 2 ca. here]

The dramatic and rapid decline in water consumption has been precipitated by a combination of several factors, the relative importance of which has not yet been satisfactory explained. One prime cause is the process of structural adjustment to the economy, in particular rapid and dramatic de-industrialization following German reunification. In the five new federal states water consumption by the industrial sector dropped by 71% – from 290 million m^3 to 84 million m^3 – between 1990 and 2004, constituting just 14.4% of total water consumption compared with 22.5% in 1990 (BGW, 2005: 11; Mensing, 2006: 11). A further contributory factor is the shift towards more extensive agricultural production practices and an increase in self-supply by industry as well as agriculture. The massive decline in population in Eastern Germany, especially in peripheral regions (see above), has also had a major impact on water consumption levels. At the same time leakage from water mains and sewers – a major problem in the German Democratic Republic – has been substantially reduced as a consequence of the infrastructure investment programmes. Particularly significant is also the sharp increase in prices for water supply and charges for wastewater collection and treatment. Having paid only a nominal fee in GDR times, many consumers in Eastern Germany now have to pay charges well in excess of those of their West German compatriots – a direct legacy of the high investment costs (see below). Finally, technological improvements – especially water-saving appliances – have contributed further to the decline in water consumption.

What have been the consequences of this dramatic drop in water consumption for the way water infrastructure systems are managed? What at first sight appears highly beneficial in environmental terms – reducing pressure on regional water resources – is from an infrastructure manager's perspective highly problematic (on the technical aspects see Koziol, 2006). The immediate problems prompted by the combination of expanding networks and declining consumption are technical and economic. Overcapacity in the technical networks means that they are under-used; that is, too little water and wastewater flows through the pipes and sewers. This raises problems of technical functionality. In the water supply system the reduced through-flow and the longer time it takes to distribute water from the waterworks to the consumer causes the water temperature to rise, encouraging bacteria, and deposits to build up on the water pipes. The consequences for sewers are increased blockages, corrosion of the drains and foul smells. Sewage treatment plants operating well below capacity – sometimes as low as 40% – do not perform to standard.

In order to maintain legally binding standards for water supply and wastewater disposal as well as to secure the functionality of the systems technical interventions are required. These include flushing water through the water mains and sewers – euphemistically termed “artificial consumption” – and retrofitting distribution pipes so they have a smaller diameter (Koziol *et al*., 2006: 50-53). In areas where the quality of drinking water is in danger of falling below the required norms, chlorinating the public water supply is currently under discussion – a solution unfamiliar in Germany and consequently a highly contentious issue (Koziol, 2004). In order to reduce the capacity of their technical networks, utilities are taking wells out of use. In larger conurbations they are closing down waterworks and sewage treatment plants surplus to requirements. In Berlin the local utility has taken six waterworks and two sewage treatment plants out of operation since reunification, requiring a major redirection of wastewater flows across the city (Moss, 2003: 522-523). In towns suffering from severe ex-migration, where surplus housing is being demolished, water and wastewater utilities are trying to ensure that the programme funding demolition and urban regeneration considers the impacts on the technical operation of the remaining infrastructure. They are keen for demolition to occur at end-points of water mains or sewers, rather than in the middle, so that they may stop operating them and thus reduce the dimensions and increase the compactness of their network as a whole (Koziol, 2006: 387-393).

There are, however, technical limits to physically down-scaling or re-ordering water and sewer networks. For several reasons capacities cannot simply be reduced in tune with annual consumption figures. Firstly, although total water use has declined, the drop in peak use (in summer months) is far less pronounced. Secondly, heavy rainstorms – increasing in frequency and intensity in the wake of climate change – demand high capacity in sewers transporting rainwater. A third argument against downscaling is that fire regulations stipulate the availability of minimum amounts of water (based on population density) to extinguish fires, requiring the retention of high-diameter mains piping particularly in areas of high-rise apartment blocks.

A further problem requiring technical solutions arises from the recent increase in groundwater levels. As water consumption decreases and less groundwater is abstracted, groundwater levels are rising. Though environmentally highly beneficial, the consequence is that in areas where groundwater levels are rising close to the surface property that was originally dry is now prone to damp or even flooded cellars. In response to this problem groundwater levels are having to be lowered artificially, raising controversial issues of responsibility and financial liability between utilities, residents and local planning authorities (Lünser and Haeder, 1998).

If the technical problems are unfamiliar but at least manageable, the economic consequences of infrastructure overcapacity and declining water consumption are far more challenging. The principal problem is that, as water consumption declines dramatically, so does the revenue from water and wastewater charges. This poses water and wastewater utilities with a dilemma. They need to finance debts for their infrastructure investments since the 1990s, yet opportunities to cut costs are limited by the high level of fixed costs, estimated at between 75% and 85% for the wastewater sector (DWA and BGW, 2005: 3). In order to offset the shortfalls incurred from declining consumption, they see no alternative to increasing sharply the unit charges. Since the mid-1990s charges for water and wastewater have increased dramatically in most municipalities of Eastern Germany, in many cases well exceeding those in

Western Germany. In the GDR households paid just 40 (East German) pfennigs per m^3 for water and 35 pfennigs per m^3 for wastewater – a negligible cost. Tenants of state or cooperative-owned flats paid no charges for water services at all (Runge 1994a: 435). Piped water today costs an average €2.15 per m^3 in the new federal states, 16% more than in Germany as a whole (€1.85) (BBU, 2007). The difference is even greater – 25% – in the case of sewage disposal, which costs an average €2.87 per m^3 in the new federal states compared with €2.28 nationally (DWA and BGW, 2005: 2-3) [5]. These average figures conceal even wider price differentiation at the local level. Even within the state of Brandenburg the combined rainwater and sewage charge per m^3 ranges between €2.40 and €5.00 (BBU, 2007). Utilities are also trying to raise and stabilise their revenues by restructuring their tariff system, combining the existing consumption-based, metered charge with a flat-rate charge (DWA and BGW, 2005). They have also increased fees sharply for first-time connections of properties to the water supply or sewer networks.

High charges for utility services have today become a major political issue in Eastern Germany, commonly referred to as a “second rent” by virtue of their sheer scale. Especially the charges for water and wastewater services are placing a huge financial burden on consumers (Haug, 2004; Schiller and Siedentop, 2005). Price increases are generally highest in those municipalities where water consumption has declined fastest and over-capacity in the networks is the greatest – in other words in areas generally worst affected by de-industrialization and ex-migration. One model calculation suggests that a decrease in settlement density of 1% leads to an increase in costs for wastewater services of 1% (BBR, 2006). Moreover, today’s charges are likely to increase even further in the future, as the population of some regions continues to decline and new investment and running costs emerge to cope with the technical problems referred to above. One commentator anticipates that wastewater charges could nominally double between 2006 and 2020 in areas worst affected by ex-migration (Oelmann, 2006: 8).

Water consumers in these ‘cold spots’ see themselves trapped in a negative spiral of ever-increasing service charges. As they try to save water in an effort to reduce their water/wastewater bills, the municipal utility responds by increasing the charge per m^3 to shore up its revenue. Not content to accept this situation of dependency, many consumers are resorting to technical and political alternatives. Those with their own gardens are reactivating or drilling new wells for water used for non-drinking purposes, although this practice is increasingly being prohibited by the authorities. Others in sparsely populated areas are challenging in the courts obligatory connections to the mains water and – in particular – the public sewer system. This applies especially to residents of communities threatened with connection to the sewage treatment plant of a neighbouring municipality which is operating well below capacity. They are, understandably, unwilling to share the financial cost of ill-planned investments by other communities and argue that decentralized wastewater treatment and re-use systems would be much more cost-effective. There is also continuous public protest against the high water/wastewater charges in many regions of Eastern Germany. This ranges from public meetings, petitions to protest marches and, in some instances, even hunger strikes.

Overcapacity problems and the modern infrastructural ideal

Beyond the immediate technical and economic problems, overcapacity in many water and wastewater networks of Eastern Germany is posing a fundamental challenge to traditional expectations and conventional practices of infrastructure development. The modern infrastructural ideal with its goal of universal service and its 'extend-and-supply' logic is being seriously undermined. On the basis of our empirical analysis above we can identify five distinct but interrelated challenges that we elaborate here.

Firstly, water consumption is not following an ever-upward curve or stagnating at a high level. This conventional assumption of water engineers has been completely dashed in the case of Eastern Germany. They can no longer expect, as they did in the past, that water consumption levels will, in the course of time, rise to take up the excess capacity of extended infrastructures. Water consumption has become much harder to predict. This is due not only to the sharp drop in water consumption generally in the wake of the unique reunification experience, but also – and increasingly today – to growing inter- and intra-regional differences in water consumption levels. In those regions and localities losing a disproportionate amount of population, economic production and financial resources water infrastructures are becoming increasingly expensive to maintain for both utilities and consumers. Water and wastewater utilities are today painfully aware of the truism that urban and infrastructure development are inextricably linked.

Secondly, the infrastructure planner's conventional image of the consumer – as a largely passive, uninterested and compliant recipient of services – is coming under increasing scrutiny. Consumers as a collective whole are becoming more unpredictable, requiring closer analysis of the behaviour of specific groups in certain localities. Nor are all consumers prepared to accept utility policy on pricing, choice of technology or investment priorities. Non-compliance is a growing phenomenon, whether in the form of protests and non-payment, clandestine use of alternative water sources or political battles for decentralized solutions for wastewater treatment. Utility managers are also having to come to terms with the unfamiliar phenomenon of the missing consumer. Population loss and economic decline are a principal factor behind the overcapacity problem, prompting some utilities to show growing interest in ways of attracting new residents and businesses to their locality (see Moss, 2003).

Thirdly and closely related to this, overcapacity poses a challenge to demand management. Conventionally, demand management is understood as a means of encouraging consumers to use fewer resources in an area of high demand so as to avoid having to extend the network. Although rather at odds with the logic of ‘extend-and-supply’, this mode of demand management has been practiced in several German cities in the recent past – such as Berlin, Hamburg and Frankfurt am Main – to improve the efficiency and environmental performance of water and wastewater networks. In Eastern Germany today many utilities, faced with problems related to overcapacity, are pursuing demand management in the opposite direction. They are interested in encouraging consumers to use more water, and are pursuing this objective primarily by modifying their tariff systems to reduce the dependency of costs on water consumption (see above).

Fourthly, the problems emanating from network overcapacity are creating new socio-spatial disparities in water service provision and exacerbating existing ones. The principal disparity relates to charges for water and wastewater services. As we have noted, price differentials are growing dramatically in Eastern Germany, with economically disadvantaged areas lumbered with heavy investment debts having to pay considerably more for basic levels of service than elsewhere. Beyond the price issue inter- and intraregional disparities are growing with respect to the quality of drinking water, levels of technological innovation and expertise within the utilities. Some degree of spatial disparity is structurally determined in Germany, where water and wastewater services are provided, by and large, by municipal or inter-municipal utilities. What we are observing today, however, is a level of differentiation in service and costs which transcends previous post-war experience and challenges the notion, embedded in regional development policy in Germany, that infrastructure systems should contribute to reducing spatial disparities.

Fifthly, water infrastructures in some parts of Eastern Germany have become more a liability than an asset. We are accustomed to view technical infrastructures as important location factors, essential for attracting business and residents. This argument was, indeed, instrumental behind the provision of such huge funds for investments in infrastructure in Eastern Germany after reunification. However, what we are witnessing in many peripheral regions of the new federal states today is a perverse reversal of this adage. Excessive charges for water supply and wastewater disposal are not only arousing protests from existing residents but frightening off potential new investors and residents. Businesses, in particular, are increasingly wary to the risks (BBU, 2007). There is anecdotal evidence of investors locating in certain municipalities only on condition they build and operate their own water and wastewater systems, in order to avoid the high and unpredictable costs of public provision.

Conclusions

In this paper we have investigated the unusual phenomenon of chronic overcapacity in water supply and wastewater disposal networks and what impacts it is having on the governance of water infrastructure systems, using the experience of Eastern Germany post-reunification as an exemplar. The paper has been framed as a contribution to the current debate on the changing relationship between infrastructures and the localities they serve, in particular on the 'splintering urbanism' thesis of Graham and Marvin. Our task has been to assess how far and in what ways the phenomenon of under-utilization of water infrastructures resulting from 'shrinking' processes in Eastern Germany resonates with the splintering urbanism thesis.

On the surface the parallels between infrastructure overcapacity on the one hand and growing fragmentation and differentiation of infrastructure systems as described by Graham and Marvin on the other might appear weak. Prominent in their story of splintering urbanism are commercially astute utilities seeking out lucrative customers and providing them with service packages tailored to their specific needs, exploiting the dependencies of mass captive customers and by-passing those considered unprofitable. Our story, by contrast, has been about utilities – and, indirectly, consumers – confronted by the technical, economic and political problems resulting from serious overcapacity in water/wastewater networks caused by a combination of rapidly declining consumption and excessive network expansion.

A closer look, however, reveals a number of resonances between core themes underpinning the splintering urbanism thesis, as summarized earlier, and the developments in Eastern Germany today. Since the issue of infrastructure overcapacity was not considered in the original splintering urbanism thesis, drawing out these similarities can help further our understanding of the nature of splintering urbanism in the very different context of 'shrinking' processes.

Firstly, our analysis of over-capacity in water infrastructures in Eastern Germany has revealed in stark form the considerable interdependence of cities and their infrastructures. That urban development depends on infrastructure development and vice versa is a truism underpinning infrastructure policy and urban planning. The relationship, however, is often taken for granted and rarely appreciated in its complexity. This paper has argued the need to appreciate the two-way nature of the relationship between urban and infrastructure development. While the splintering urbanism debate has focused on how infrastructure provision – and, in particular, infrastructure providers – can shape urban development in ways not previously appreciated, we have highlighted here how urban and regional development trends – in this case de-industrialization and ex-migration – can also substantially shape infrastructure development and service provision. This is in no way intended to downplay the role of utilities as powerful players in the governance of infrastructure systems, rather to generate greater sensitivity for the way their strategies are framed by spatial development processes often beyond their control. What we can observe in

Eastern Germany is how spatial disparities in socio-economic development are being reproduced in utility service provision and how, conversely, growing disparities in the quality and cost of these services are reinforcing socio-spatial differentiation.

Secondly, the paper has demonstrated the vulnerability of infrastructure systems to a sudden drop in usage. Infrastructure planners and utility managers are familiar with the difficulties posed by surges in demand exceeding network capacity. They respond either by extending the network to meet the increased demand (following the traditional ‘extend-and-supply’ logic) or by applying demand management to avoid the necessity for infrastructure expansion. Overcapacity in water infrastructures of Eastern Germany has, however, taken them by surprise. The established relationship between the components of an infrastructure system – the natural resources, the physical networks, the stakeholders and the institutional arrangements – has become destabilized, offering no ready solutions. As consumers either disappear or use less water utility revenues decline, jeopardising the repayment of heavy debts for recent infrastructure improvements. A vicious circle ensues, with utilities raising water and wastewater charges to recoup lost revenue and consumers responding by using even less water or not locating in that service area at all. Alternative solutions, such as downscaling the technical networks or connecting neighbouring settlements, involve considerable additional investment costs and are often politically contentious.

Thirdly, the case of overcapacity is revealing important aspects of path dependency of infrastructure systems. The fundamental problem illustrated in this paper concerns the embeddedness of infrastructure systems and their inability to adapt adequately to consumption trends which buck the long-term pattern of continuous growth. This embeddedness – we should note – is multi-dimensional, covering not only physical, but also institutional and socio-economic dimensions. We have observed how physical networks, once built, require a certain minimum through-flow of water or wastewater to operate both effectively and efficiently. Since downscaling is often not viable technically or financially, utilities in this situation generally feel bound to raise tariffs whilst at the same time exploring ways of increasing demand – i.e. with two strategies sending contradictory signals. In the interest of maintaining existing infrastructure consumers are called on to pay higher tariffs whilst environmental considerations to conserve water are jettisoned. This reveals the inflexibility of the institutional and financial arrangements for securing adequate infrastructure provision. The strict obligation for local households to be connected to public mains and sewers combined with generous public subsidies for infrastructure investments in the early 1990s provided little incentive for municipal water and wastewater utilities to consider alternative solutions to large-scale, standardized technologies. Today, with the investments made and the networks built, both utilities and residents (households and businesses) are locked in to a sub-optimal situation which only grows worse as consumers try to reduce the amount of (publicly supplied) water they use and as they continue to leave the locality.

As the stakeholders tussle with this dilemma, the modern infrastructural ideal – as interpreted and institutionalized in Germany – is coming under increasing scrutiny. Debates have opened up around whether to modify the political goal of achieving similar infrastructure services in all parts of the country and whether exemptions to obligatory connection to public infrastructures should be permitted. Other ongoing debates are on how far decentralized technologies for wastewater treatment could be part of mainstream infrastructure strategies, what role private providers can play in resolving some of the problems associated with overcapacity and how benchmarking schemes could improve transparency of water service quality and costs across the country. This recent openness to alternatives is, in itself, a welcome sign of adaptation to changing circumstances. Had it come in the immediate aftermath of reunification it may have been possible to avoid some of the mistakes made when extending and upgrading the water infrastructures of Eastern Germany. Today, the trick will lie in identifying what elements of the modern infrastructural ideal need revising and what are worth pursuing under the very different conditions of Germany in the twenty-first century.

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Footnotes

[1] See the online journal 'Städte im Umbruch' under http://www.schrumpfende-stadt.de/magazin.htm, accessed on 15 November 2007.

[2] See http://www.bbr.bund.de/cln_005/nn_85554/SharedDocs/GlossarEntry/B/Bevoelkerungsentwicklung__LRB.html, accessed on 15 November 2007.

[3] This paper is based on research funded by the Institute for Regional Development and Structural Planning (IRS) and by the German Federal Ministry for Education and Research (BMBF) and conducted at the IRS between 2002 and 2006. Previous publications from this research include: Moss (2003); Monstadt and Naumann (2005); Monstadt and von Schlippenbach (2005); Naumann and Wissen (2006).

[4] www.statistik-portal.de /Statistik-Portal/de_jb10_jahrtabu3.asp of the Statistisches Bundesamt, accessed on 16 March 2007.

[5] Based on a survey of wastewater utilities in 2005, with responses covering 59% of the national population.

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Table 1: Length of public sewers, the new federal states and Berlin, 1998-2004 (in km)

	1998	**2001**	**2004**
Berlin	8,813	9,100	9,330
Brandenburg	10,679	14,645	16,947
Mecklenburg-Upper Pomerania	8,067	10,770	11,750
Saxony	18,962	21,271	23,252
Saxony-Anhalt	10,638	15,118	16,884
Thuringia	10,737	12,398	14,954
Total	**67,896**	**83,302**	**93,117**

Source: www.regionalstatistik.de, accessed on 4 April 2007.

Table 2: Water distribution to end-consumers in the new federal states and Berlin, 1991-2004 (in million m^3)

	1990	1991	1995	1998	2001	2004
Berlin	-	275	233	215	206	206
Brandenburg	-	185	119	112	110	109
Mecklenburg-Upper Pomerania	-	142	93	83	83	84
Saxony	-	336	206	188	187	190
Saxony-Anhalt	-	222	134	122	109	108
Thuringia	-	185	120	99	98	97
Total	**1,604**	**1,345**	**905**	**819**	**793**	**794**

Sources: Statistisches Bundesamt (1994, 1999, 2001, 2003, 2005); BGW (2005)